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Geographic and socioeconomic inequalities in cesarean birth rates in Peru: A comparison between 2009 and 2018

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Abstract

Background: There is a global concern about the high rates of cesarean birth (CB). This study aimed to investigate the geographic and socioeconomic inequalities in CB rates in the Peruvian population.

Methods: We conducted a population-based study using the Peruvian Demographic and Family Health Surveys (ENDES, the Spanish acronym for *Encuesta Demográfica y de Salud Familiar*) between 2009 and 2018. ENDES reported data from births registered in the five years preceding survey execution. For the years 2009 (n = 10 289) and 2018 (n = 23 077), we calculated the weighted rates of CB among variables such as natural geographic domain (Coast, Andean, or Amazon), area of residence (rural or urban), wealth index quintile (quintile 1 is poorest, and quintile 5 is richest), and educational level. To assess inequalities, we calculated the concentration index (CIs), the slope index of inequality (SII), and the relative index of inequality (RII).

Results: The CB rates by year were 21.4% (95% confidence interval [CI]: 20.0-22.9) in 2009 and 34.5% (95% CI: 33.4-35.5) in 2018. Women living in urban and coastal regions and with a higher education level had the highest CB rates. All the CIs were positive, reflecting a prowealthy inequality in CB rates, and both SII and RII were positive, indicating a gap between the use of cesarean in women in the higher wealth quintile compared with those in the lower quintile.

Conclusions: Cesarean birth rates have increased by 60% during the last decade in Peru. The richest wealth quintiles had the highest CB rates during the study years, which were well above global recommendations.

KEYWORDS

cesarean section, health care disparities, health surveys, maternal health, maternal health services, Peru (Source: MeSH)

1 | INTRODUCTION

Cesarean birth (CB) is a surgical alternative to vaginal delivery and is useful for reducing maternal and neonatal mortality in medical conditions requiring its use.[1] Several studies have shown that performing a CB without adequate medical justification does not provide additional maternal and child health benefits.[2,3] As with any surgical procedure, cesareans are not exempt from complications in either the mother or the child in the short, medium, and long term, especially in contexts that do not have the basic equipment conditions and trained health personnel.[1,2] Therefore, its indication must be individualized and based on clear clinical criteria.[1]

Based on a systematic review and an ecological study, the World Health Organization (WHO) has reported that percentages of cesarean births greater than 10%-15% of the total deliveries are not associated with an increase in the benefit of reducing maternal, neonatal, or infant mortality.[1] However, by 2015, approximately 29.7 million cesareans had been conducted worldwide, indicating that 21.1% of all deliveries were performed with this surgical procedure. This proportion was close to double what was reported for the year 2000 (16 million cesareans [12.1%]), for an average annual increase of 3.7% worldwide for the period from 2000 to 2015.[4] It has been estimated that 2.3 billion USD is spent annually on unnecessary CB procedures.[5] The growing prevalence of this procedure suggests a pattern of overuse; more cesareans are performed that are medically indicated, increasing the possibility of complications or disabilities, and even death related to this procedure.[1] Furthermore, scarring produced by CB is also related to complications in future pregnancies such as ectopic pregnancy, scar dehiscence, abnormal placentation, and uterine bleeding.[6]

Globally, inequalities in the use of maternal health services[7] and the distribution of maternal morbidity and mortality have been well documented.[8] Specifically, the proportion of cesareans performed between and within countries are inconsistent, despite similar proportions of institutional deliveries.[4,8] There are also differences in the proportion of cesareans between public and private institutions, in the educational level of women who undergo the procedure, and according to socioeconomic level, with the most economically disadvantaged groups having fewer cesareans relative to wealthier groups.[4,8]

Although Peru has achieved the proposed Millennium Development Goal to reduce maternal mortality, access to maternal health continues to vary greatly in different regions and across population groups.[9] CB rates in Peru have increased in recent decades, from 8.7% in 1996 to 34.5% in 2018, with a higher prevalence in urban (41.0%) than in rural areas (15.7%) and in women with a higher educational and socioeconomic status.[10,11] Although some authors have described how maternal health is addressed in different population groups according to sociodemographic and clinical characteristics,[9,12] no study has evaluated inequities in the use of CB by geographic and sociodemographic characteristics at a national level in Peru. The purpose of this study was to investigate geographic and socioeconomic inequalities in CB rates in Peruvian women.

2 | METHODS

2.1 | Design and study population

We performed a cross-sectional, analytical study of secondary data collected by means of the Peruvian Demographic and Family Health Surveys (*Encuesta Demográfica y de Salud Familiar*, known as ENDES for its acronym in Spanish) from 2009 to 2018; these surveys include data from women between 15 and 49 years of age who reported having given birth in the five years preceding the survey.

ENDES is an annual survey designed according to the MEASURE-DHS model, promoted by the DHS program and conducted at a national level by the National Institute of Statistics and Informatics (INEI) that provides information on indicators of fertility, mortality, maternal and child health, and communicable and noncommunicable diseases in Peru.[11,13] Comparisons of cesarean rates were carried out for the time period between 2009 and 2018 because these are the earliest and latest dates for which ENDES survey data are available. ENDES presents a two-stage, probabilistic balanced-type sampling, which is stratified and independent at a regional level and by urban and rural areas.[11,14]

Geographically, Peru can be divided into three natural regions, including the Coast (which borders the Pacific Ocean), the Andean region (limited by the Andes Mountains), and the Amazon (in the Peruvian Amazon). In Peru, the Ministry of Health (MINSA) provides health services to 60% of the population (poor and extremely poor populations), whereas the Social Security System (EsSalud) provides services to 30% of the population, and the Armed Forces and the private sector together provide services to the remaining 10%.[15]

The sampling method used by ENDES enables samples approximately equal to the characteristics of the target population of the survey by replicating the structure of the population by age groups, sex, and other variables. Hence, the results obtained from the analysis of this annual survey provide representative estimates of national (total Peruvian population), urban, and rural areas, and of all natural and administrative regions. Further information on the collection and processing of ENDES data is available at https://bit.ly/2Fj9IbP.

2.2 | Variables and measurements

The dependent variable was cesarean birth in women aged 15 to 49 years. It should be noted that ENDES includes data on deliveries that occurred in the five-year period preceding the date of the survey. ENDES gathers information by means of three main questionnaires: (1) the home questionnaire; (2) the individual questionnaire for women (15 to 49 years old); and (3) the health questionnaire. We used past birth history from the women's individual questionnaire to collect information about cesarean rates. In this questionnaire, the women were asked about different aspects of their previous births and pregnancies, including questions related to antenatal and birth care.

Since an association has been described between geographic and sociodemographic variables and the performance

of cesareans,[7,16,17] the following independent variables were included in the study (the code of the question in the ENDES survey that provides the data used to obtain the variables of interest is shown in parentheses): educational level (V106) categorized as no formal schooling or primary, secondary, and higher; wealth quintile (V190) classified as poorest, poorer, middle, wealthy, and wealthiest; geographic domain (SHREGION) categorized as Coast, Andean region, and Amazon; and area of residence (V025) classified as rural and urban.

2.3 | Statistical analysis

Demographic and socioeconomic characteristics, and the outcome variable, were described by absolute frequencies and weighted proportions with 95% confidence intervals (95% CI). The Rao-Scott chi-square test was used to analyze group differences.

The measurement of inequality in the use of cesarean for mode of delivery between the years 2009 and 2018 was carried out by means of the concentration index (CIs), which is a coefficient ranging from the interval of −1 to 1, where 0 means complete equality. A positive value indicates that the distribution of the variable studied is concentrated in the population with the highest wealth index and vice versa. The *conindex* command[18] was used to calculate these indices. The *Z* test was used to assess the differences between CIs by year.

Likewise, socioeconomic inequalities for cesareans were measured using two inequality measures: the slope index of inequality (SII) and the relative index of inequality (RII). An advantage of the use of these indices is that they take into account the entire socioeconomic distribution. The SII provides the absolute difference in the prevalence of the outcome between the participants with the lowest socioeconomic levels and those with the highest socioeconomic level. In contrast, the RII provides the relative difference between the groups described. For this study, women were cumulatively classified from 0 to 1 according to their wealth index so that "zero" represented the lowest wealth index, and "one" represented the highest wealth index. The interpretation of these indices is given as follows: SII values below 0 and RII values below 1 indicate that people with a lower wealth index are more likely to have a CB compared with those with a higher wealth index.[19]

All analyses were performed with Stata version 14.2 (Stata Corp., College Station, TX, USA), and weighting factors and sampling design were included in all estimates.

2.4 | Ethical considerations

This study did not require approval from an Institutional Ethics Committee for its completion as only analyses of deidentified secondary data were performed.

3 | RESULTS

Data from 10 289 (2009), 9281 (2010), 9146 (2011), 9620 (2012), 8983 (2013), 9610 (2014), 23 821 (2015), 21 175 (2016), 21 528 (2017), and 23 077 (2018) women were included in the study. In relation to the characteristics of the populations studied, in the comparison between the first (2009) and last year (2018) of the study, in relation to the area of residence, 64.4% (62.6-66.2) and 74.1% (73.2-74.9) lived in urban areas, respectively. In terms of geographic region, between 2009 and 2018, there was an increase (46.2% to 55.3%) in inhabitants from the coastal region accompanied by a decrease in the Andean region (37.8% to 27.5%). The proportion of inhabitants living in the Amazon remained similar (16.0% and 17.2%, respectively) between the same years (Table 1). In relation to the wealth index, similar proportions were represented in the categories of this index for the years 2009 and 2018. In relation to the level of education between 2009 and 2018, there was an increase in the population with a higher educational level (from 22.5% to 35.3%) with a decrease in the population without formal education or with a primary level of education (from 34.9% to 20.7%).

In the study period (2009-2018), there was an increase in the annual proportions of cesareans. Figure 1 shows the prevalence of cesareans in weighted proportion and according to wealth quintiles, educational level, natural region, and place of residence for each year of study. During this ten-year period, the higher the wealth quintile, the higher the prevalence of cesarean. The prevalence of CB in the population in the lowest wealth quintile (quintile 1) was less than 15% for all the study years, whereas the highest wealth (quintile 5) showed rates above 50% since 2014. The increase in the prevalence of CB in this decade is more pronounced in the population with the highest wealth index (quintile 5), with an increase of 15.5 percentage points, whereas in quintile 1, the increase was 7.6 percentage points during this period. A similar pattern, but with a lower yearly increase in the prevalence of cesareans, was found when analyzing this outcome according to education; the greatest difference in the prevalence of cesareans was between women with a secondary and higher education level. Natural region and place of residence showed a similar pattern in which the prevalence of CB consistently increased between 2009 and 2018.

In relation to the prevalence of CB, 21.4% (95% CI: 20.0-22.9) and 34.5% (95% CI: 33.4-35.5) of deliveries occurred by means of this surgical procedure during 2009 and 2018, respectively (Table 2). The proportions of cesareans performed according to the place of residence remained similar at 87.6 (95% CI: 85.2-89.6) and 88.2% (95% CI: 87.1-89.2) in the urban area in 2009 and 2018, respectively. According to geographic region, the proportions of cesareans performed were similar for both study years, with the highest number occurring in the coastal region—72.4%

TABLE 1 Background characteristics of respondents, Peru, 2009 and 2018

Characteristics	2009		2018	
	Weighted percent[a]	Unweighted number	Weighted percent[a]	Unweighted number
Total	100	10 289	100	23 077
Place of residence				
Rural	35.6 (33.8-37.4)	4637	25.9 (25.1-26.8)	7097
Urban	64.4 (62.6-66.2)	5652	74.1 (73.2-74.9)	15 980
Natural region				
Coast	46.2 (43.9-48.5)	3102	55.3 (54.1-56.4)	9704
Andean	37.8 (35.5-40.2)	4260	27.5 (26.3-28.7)	7794
Amazon	16.0 (14.4-17.7)	2927	17.2 (16.4-18.2)	5579
Wealth index				
Poorest	24.6 (22.6-26.7)	3157	25.1 (24.1-26.0)	6862
Poorer	23.4 (21.7-25.3)	2824	23.0 (22.1-24.0)	5944
Middle	21.1 (19.5-22.9)	2154	19.8 (19.0-20.6)	4454
Richer	17.2 (12.1-15.4)	1336	17.0 (16.2-17.8)	3372
Richest	13.7 (12.1-15.4)	818	15.1 (14.2-16.0)	2445
Level of education				
No formal schooling/ primary	34.9 (33.2-36.7)	4196	20.7 (19.8-21.6)	5163
Secondary	42.6 (40.7-36.7)	4207	44.0 (42.9-45.0)	10 408
Higher	22.5 (20.8-24.2)	1886	35.3 (34.3-36.3)	7506

[a]Weighted percentages are according to sampling specifications and weights of ENDES by year.

[95% CI: 69.4-75.3] and 70.0% [95% CI: 68.5-71.5] for 2009 and 2018, respectively. In relation to the wealth index, approximately half of the cesareans occurred in women in the two highest wealth quintiles (quintiles 4 and 5; 56.5% [2009] and 50.0% [2018]). In addition, the lowest proportion of cesareans for both years of study occurred in the poorest women (quintile 1; 6.7% [2009] and 9.8% [2018]). In relation to the educational level, there was a higher proportion of cesareans in women with a higher educational level, with 41.0% (95% CI: 37.2-45.0) and 51.2% (95% CI: 49.4-53.1) in 2009 and 2018, respectively.

Table 3 shows that for the years 2009 and 2018, all CIs were greater than zero, which indicates that the use of CB for delivery was concentrated in the population with greater purchasing power, in both the general population and those according to characteristics such as the area of residence, natural region, and level of education. Between 2009 and 2018, there was a statistically significant decrease in CIs (difference of −0.095, $P < .001$) for the general population and for women in the amazon region (difference of −0.0871, $P = .044$). In general, there was a decrease in the CIs in all the characteristics evaluated, except for the population without any formal education or among those with a primary education wherein there was an increase in the Cis—though these differences were not statistically significant. In relation to SII, there were positive values of 29.9 (95% CI: 20.5-39.4) in 2009 and 19.5 (95% CI: 11.7-27.3) in 2018, indicating a difference in the number of cesareans between the group with the highest and lowest wealth index (quintiles 5 and 1, respectively). In relation to RII, these values were 4.8 (95% CI: 2.1-7.5) in 2009 and 2.7 (95% CI: 1.4-4.0) in 2018, indicating that for these study years, the probability of giving birth by cesarean was 4.8 times versus 2.7 times, respectively, between the groups with greater and lesser wealth.

4 | DISCUSSION

This work aimed to examine socioeconomic inequalities in the use of cesareans in Peruvian women; we found a progressive increase in the proportion of cesarean births between 2009 and 2018. At higher wealth quintiles, the proportion of deliveries by cesarean was also higher and concentrated in women with a higher wealth index. The proportions of this procedure in population groups with the highest wealth index are well above international recommendations.[1] Given the risk of negative health sequelae because of excessive use of this surgical procedure,[1,2] there is an urgent need to study the factors that contribute to the overuse of cesarean in these groups.

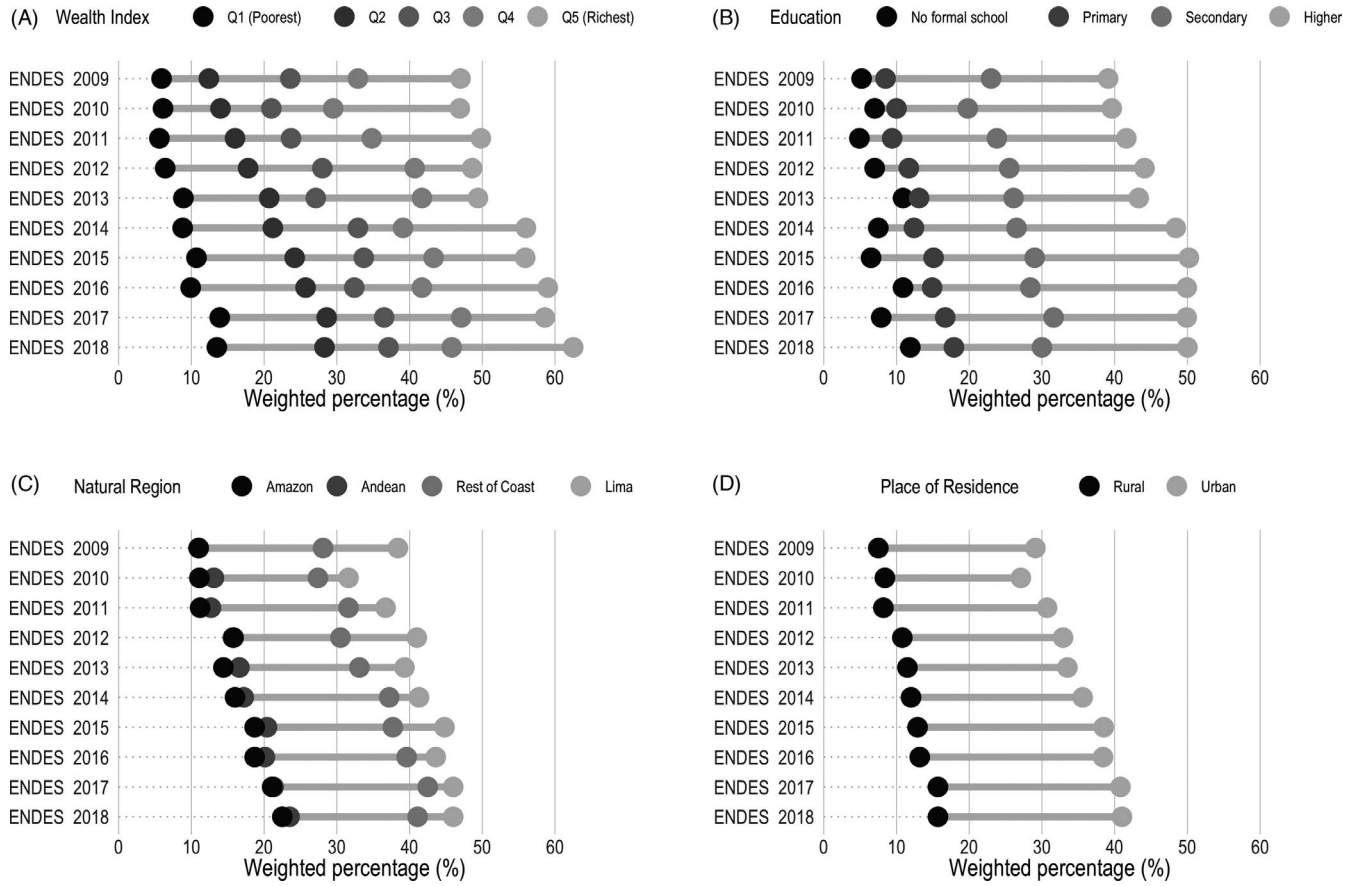

FIGURE 1 Cesarean birth rates by wealth index, Peru, 2009-2018

Our findings show an increase in the proportion of cesareans during the study period, with 3 out of 10 births occurring by means of cesarean in 2018 compared with 2 out of 10 deliveries in 2009. Global and Latin American "epidemics" of cesareans have been described over recent decades, and according to the WHO, a cesarean birth rate above 10%-15% does not constitute a benefit in terms of maternal or child health.[1,4,20-22] These figures indicate a public health problem since the CB is in itself an independent risk factor for the development of complications that may require admission to the intensive care unit, hysterectomy, or blood transfusion, and longer hospital stays—all of which represent higher costs and burden on health systems, especially in low-income and middle-income countries.[23,24] In addition, cesarean birth is associated with risks in future pregnancies that may also end in a cesarean and contribute to complications for both the mother and the newborn,[25] a situation that has been described in the Peruvian context.[12,26] Given the high prevalence of cesareans in this population, it is important to identify the factors that promote this type of delivery in Peru, so as to avoid possible complications attributable to its overuse.

In the present study, the ratio of CB between urban and rural areas of residence was 8:1, with a sustained greater proportion of cesareans in urban areas over time.[27,28] We also found that the majority of cesareans occur in the coastal region; 7 out of 10 deliveries performed in this region occurred by CB. These findings may be explained, in part, by the fact that health centers performing cesareans in Peru are usually located in the urban or peri-urban areas of large cities of the coastal region, and in private centers that have higher CB rates in both Peru and other countries around the world.[7,29-31] These health centers tend to be located in urban areas or areas of greater economic development, as is the case with the cities located in the coastal region of Peru. Since this procedure is more expensive than a vaginal birth and requires a greater quantity of medical resources, economic motivations may induce more frequent use of cesarean among the population care for in private centers. Moreover, private health care users may also have personal preferences for delivery by cesarean,[29] as has been described in other countries.[32,33] The marked differences found according to the place of residence and natural region indicate overuse of cesarean for delivery in some population groups; at the same time, populations in rural and noncoastal areas may have difficulty obtaining access to this surgical procedure at all. This means the overuse and underuse may be occurring simultaneously. Further studies are needed to determine the factors that explain these differences.

Women with a secondary or higher education underwent a higher proportion of cesareans compared with those without any formal education or those with primary education.

TABLE 2 Cesarean births in the general population and by characteristics, Peru, 2009 and 2018

Characteristics	2009 Weighted percent (95% CI)	2009 *P*-value[a]	2018 Weighted percent (95% CI)	2018 *P*-value[a]
Total	21.4 (20.0-22.9)		34.5 (33.4-35.5)	
Place of residence				
Rural	12.4 (10.4-14.8)	<.001	11.8 (10.8-12.9)	<.001
Urban	87.6 (85.2-89.6)		88.2 (87.1-89.2)	
Natural region				
Coast	72.4 (69.4-75.3)	<.001	70.0 (68.5-71.5)	<.001
Andean	19.4 (16.8-22.2)		18.7 (17.5-20.1)	
Amazon	8.2 (6.9-9.8)		11.3 (10.4-12.2)	
Wealth index				
Poorest	6.7 (5.3-8.5)	<.001	9.8 (8.9-10.8)	<.001
Poorer	13.5 (11.4-16.0)		18.9 (17.5-20.3)	
Middle	23.3 (20.2-26.7)		21.3 (19.9-22.8)	
Richer	26.4 (22.8-30.4)		22.6 (21.1-24.2)	
Richest	30.1 (26.2-34.1)		27.4 (25.4-29.5)	
Level of education				
No formal schooling/primary	13.2 (11.3-15.5)	<.001	10.5 (9.5-11.5)	<.001
Secondary	45.7 (41.8-49.7)		38.3 (36.6-40.1)	
Higher	41.0 (37.2-45.0)		51.2 (49.4-53.1)	

Abbreviation: CI, confidence interval.

[a]Using the chi-square test statistics.

TABLE 3 Changes in the concentration index for cesarean births, Peru, 2009 and 2018

Characteristics	2009	2018	Difference	*P*-value[a]
General population	0.3704	0.2751	−0.0953	<.001
Place of residence				
Rural	0.3612	0.2917	−0.0695	.237
Urban	0.2196	0.1881	−0.0315	.137
Natural region				
Coast	0.1603	0.1549	−0.0054	.817
Andean	0.3986	0.3414	−0.0572	.168
Amazon	0.4577	0.3705	−0.0871	.044
Level of education				
No formal schooling/primary	0.3250	0.3493	0.0242	.636
Secondary	0.2181	0.1911	−0.0270	.375
Higher	0.1900	0.1563	−0.0338	.179
SII (95% CI) of wealth index	29.9 (20.5-9.4)	19.5 (11.7-7.3)		
RII (95% CI) of wealth index	4.8 (2.1-7.5)	2.7 (1.4-4.0)		

Note: CI, confidence interval; SII, slope index of inequality; RII, relative index of inequality.

[a]*Z* stat for differences.

This finding was observed in different years of the ENDES study.[11,16,27,34] Globally, the relationship between educational level and CB rates varies, with some contexts showing an increase[17,35] and some a decrease[36,37] according to the rise in educational level. Educational level could be associated with better access to obstetric care because of the autonomy and ability of women with a higher education level to make decisions about their health.[38] Moreover, accurate and clear information on the risks and benefits of both modes of delivery (vaginal or cesarean) is useful for any pregnant woman, but especially so for those attending private health centers where surgical delivery may be promoted. However, in some cases in Peru, this information is not provided to pregnant women by health practitioners.[39,40] Preferences toward cesarean birth vary according to the health care setting. Paradoxically, it has been described that in countries with high rates of cesareans, women have a preference for vaginal delivery, which indicates that there may be factors in the health care environment that determine delivery by CB.[37,40,41] Taking this and the results of this present study into account, more research is needed to determine how education and knowledge of delivery options affect delivery choices in the Peruvian context. There is also an urgent need to develop strategies for reducing the high proportion of cesarean births performed in Peru.

In relation to the wealth quintiles, there was an increase in the proportion of cesareans for all quintiles and in the general population in the period between 2009 and 2018. There was also a significant difference in the proportion of cesareans among women in the higher and lower wealth quintiles. These results indicate a concentration of the use of cesareans in women with a higher wealth index. The association of CB among women with a higher wealth index or higher socioeconomic status has been described in other studies on Peru and worldwide,[7,16,42] with an increasingly higher rate of cesareans being performed in the richest compared with the poorest groups.[16] Possible explanations for these differences include greater access to this invasive procedure by women with greater purchasing power and access to private health care,[43] and the presence of geographic and economic barriers for access to cesareans in women of lower resources.[44] In the present study, the most economically disadvantaged groups (quintiles 1 and 2) in the 2009 and 2018 ENDES surveys reported CB rates below or close to 10%-15%, which, according to the WHO, are within the values for which benefits in decreasing morbidity and maternal and infant mortality may be obtained. Thus, it is necessary to study the factors that have led to an increase in cesareans in the richest groups, and those that act as barriers to access to cesareans among the most disadvantaged populations. In these populations, improved access to necessary cesareans would provide health benefits. Indeed, strategies favoring access to cesareans in economically disadvantaged populations, such as health insurance coverage for women and children, have been described in the literature.[45]

This study has several limitations. The use of secondary data from a survey may produce problems related to the precision and accuracy of the data collected. ENDES collects data on pregnancies in the last five years. Therefore, the information on earlier pregnancies is not recorded in the database, and this might affect the accuracy of the results obtained. Despite this, ENDES is a nationally representative survey, which is widely used to assess maternal health indicators in the Peruvian population. It also provides an approach to studying inequalities in the use of CB in the Peruvian population, which has become a priority issue in recent years given the high rates of presumably unnecessary surgical births that have been reported for the country and throughout the world.

4.1 | Conclusions

In conclusion, we found an increase in the rate of cesareans from 2009 to 2018. We found that one in three pregnancies in Peru are delivered by means of this surgical procedure with a high degree of geographic variation. CB rates are well above international recommendations in most communities in Peru, and there are inequities in the proportion of cesareans by wealth quintile, region, and socioeconomic status among women. These findings suggest that clinical indication alone is not driving the cesarean rate in Peru, for there should not be differences in this proportion according to socioeconomic characteristics alone. Further work is needed to identify the factors that influence the use of CB in different population groups along with strategies for rightsizing the rate of surgical delivery based on patient need and not just one's ability to pay.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests.

DATA AVAILABILITY STATEMENT

The ENDES datasets are available at Microdatos INEI: http://iinei.inei.gob.pe/microdatos/

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